TAKU RIVER COHO SALMON (*Oncorhynchus kisutch*) ADULT ESCAPEMENT AND JUVENILE TAGGING INVESTIGATIONS, 1987

By

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Regional Information Report[1] No. 1J88-13

Alaska Department of Fish and Game
Division of Commercial Fisheries
Douglas, Alaska

June 1988

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ACKNOWLEDGEMENTS

I wish to acknowledge the contribution of the seasonal personnel who helped collect the basic data essential to the development of this report. In particular, Dennis LeMond and Kent Crabtree, who supervised coded-wire tagging operations should be credited for their dedication in collecting data for this report. Other tagging crew members were Steve Schrof and Susan Jordan. Pat Kellen, Jarbo Crete and Chris Pastora assisted in the tagging operation at Speel Lake. Ian Mathews (DFO, Whitehorse) dedicated many hours to the tagging operation at Little Tatsamenie Lake in spite of his substantial time commitment to the adult weir operation. Pat Milligan (DFO, Whitehorse) helped plan, supervise and supply that project. Steve Elliott supervised the Yehring Creek project and, along with Joe Muir, conducted escapement surveys on lower Taku River tributaries. Paul Kissner shared his extensive knowledge of the Taku River system which contributed greatly to the efficiency and success of the project. Editorial review was done by Gary Gunstrom.

PROJECT SPONSORSHIP

This investigation was financed by NOAA, National Marine Fisheries Service under Cooperative Agreement No. NA-87-ABH-00025.

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ABSTRACT

In 1987, the Alaska Department of Fish and Game (ADF&G), Commercial Fisheries Division coded-wire tagged juvenile coho salmon at two locations in the Taku River drainage (Little Tatsamenie Lake and the Dudidontu River) and at Speel Lake in Port Snettisham. The tagging operation at Little Tatsamenie Lake was a joint effort with the Canada Department of Fisheries and Oceans (DFO). Total numbers of fish tagged by location were 11,426 at Little Tatsamenie Lake, 1,217 at the Dudidontu River and 10,267 at Speel Lake. In addition, 3,575 juvenile chinook salmon were tagged at the Dudidontu River. Major differences in abundance and species composition were found in minnow trap catches in the Dudidontu River compared with catches in similar habitat in the upper Nahlin River during the previous summer. Overall, juvenile salmon were considerably less abundant in the Dudidontu River while resident species, particularly Dolly Varden, were more numerous. These differences may be related to velocity restrictions to upstream migration of adult salmon to spawning and rearing habitat in the Dudidontu River. Aerial escapement survey counts and a weir count on three upper Taku River tributaries indicated that escapement of early coho salmon stocks was lower than in 1986. In contrast, surveys in lower river tributaries indicated a relatively strong escapement of fall stocks compared with 1986 and most other years for which records are available.

KEY WORDS: Taku River, coho salmon, *Oncorhynchus*, coded-wire tagging, escapement

INTRODUCTION

The Taku River arises in British Columbia, Canada and flows to the sea in Southeastern Alaska (Figure 1). Tributaries in both the U.S. and Canadian portions of the system support populations of coho salmon that contribute to commercial, recreational, and subsistence fisheries. Ratification of the Pacific Salmon Treaty opened the way for cooperative research on factors that may limit production and patterns of exploitation of this shared resource. The Alaska Department of Fish and Game (ADF&G), Commmercial Fisheries Division initiated a project in 1986 to coded-wire tag selected stocks in the Taku River system and develop an annual index of escapement (Shaul 1987). This project compliments and is conducted cooperatively with research projects of the ADF&G, Sport Fish Division, the National Marine Fisheries Service (NMFS) and the Canada Department of Fisheries and Oceans (DFO).

In 1986, juvenile coho salmon were tagged at three locations in the upper Taku River drainage including the Nahlin River (ADF&G), Little Tatsamenie Lake (ADF&G and DFO) and the Sheslay River near the mouth of the Hackett River (DFO). Observations of the timing of migration and spawning indicate that the Nahlin and Hackett River populations are early (summer) stocks that enter the lower river in July and August while the Tatsamenie River population is a late (fall) stock that probably enters the lower river during late August to mid October. DFO personnel also tagged juvenile coho salmon in lower river rearing areas on the Canadian side of the border while the ADF&G, Sport Fish Division tagged smolts at Yehring Creek, a U.S. tributary (Elliott 1987). Fish tagged at both of those locations were probably representative of the predominant later migrating (fall) stocks in the mainstem valley. In addition to tagging operations, a number of tributaries in the upper system was examined for their potential as escapement indicators. Two of those, the Dudidontu and upper Nahlin Rivers, were judged to be suitable for conducting comparable aerial surveys (Shaul 1987).

In 1987, coded-wire tagging was repeated at Little Tatsamenie Lake and mainstem tributaries. A tagging operation was also conducted at the Dudidontu River and at Speel Lake which drains into Port Snettisham south of the mouth of the Taku River. Past tagging studies conducted at Speel Lake and lower Taku River tributaries indicated that coho salmon stocks from those locations had similar migratory patterns and harvest distributions in the highly mixed-stock troll and purse seine fisheries while lower Taku River stocks were more available to the drift gillnet fishery in District 111 (Figure 2). Therefore, the Speel Lake stock may be a relatively good indicator of the harvest rate of fall Taku River stocks in the more mixed-stock fisheries.

JUVENILE SALMON CODED-WIRE TAGGING

Juvenile coho salmon were captured and coded-wire tagged at the Dudidontu River, Little Tatsamenie Lake, and Speel Lake (Figure 1). Chinook salmon that were captured incidentally at the Dudidontu River were also tagged.

Methods and Procedures

Wire-mesh minnow traps were used to capture juvenile salmon for tagging. Approximately 100 traps baited with salmon roe were checked and set twice daily at 4-hour intervals in suitable appearing habitat. Salmon roe was disinfected prior to use by immersion in a 5% Betadyne solution for 15 minutes. Traps were moved frequently to maintain the highest possible catch rates. Juveniles were held in pens before tagging until a total of 1,000 to 4,000 was captured, but not for a period longer than 4 days.

Fish of 60 mm fork length or larger were coded-wire tagged and released except at the Dudidontu River where fish as small as 55 mm were tagged. A 60 mm division point was used because smaller fish are primarily age 0 fry which are more difficult to tag, have a lower survival rate, and are less likely to smolt the following spring compared with larger, older fish. Smaller fish were tagged at the Dudidontu River because of a scarcity of age 1 juvenile coho salmon. A description of the coded-wire tagging technique under field conditions is found in Koerner (1977).

Fish that were sampled for age and length were measured from the tip of the snout to the fork of the tail (to the nearest millimeter). Several scales were taken from the preferred area on the left side of the fish approximately two rows above the lateral line and on the diagonal row downward from the posterior insertion of the dorsal fin. Scales were mounted between glass slides.

Results and Discussion

The following is a summary of juvenile salmon coded-wire tagging conducted in the Taku River drainage by the Alaska Department of Fish and Game, Commercial Fisheries Division in 1987.

Little Tatsamenie Lake

A total of 11,426 juvenile coho salmon was tagged at Little Tatsamenie Lake during 21 July-14 August (Table 1). This was a joint effort between ADF&G and DFO.

The best trapping success occurred in the west branch of the inlet stream, while the littoral zone of the lake was not as productive as it was in

September 1986 (Shaul 1987). The overall average catch per trap of fish that were tagged (60 mm and larger) was 6.9, which was substantially lower than the average catch of 12.0 per trap in 1986. Tagged coho salmon ranged from 60-121 mm and averaged 76.8 mm (N = 712; std. error = 0.4; Appendix A.1). Scale samples indicated that fish less than 72 mm in length (approximately half of the total) were predominantly age 0+ while fish over that length were predominantly age 1+. Age 0+ fish averaged 64.1 mm (N = 41; std. error = 0.6; Appendix A.2). The mean length of age 0+ fish in the population was probably somewhat smaller because only fish that were 60 mm or greater were included in the sample. Age 1+ fish from a random sample of the catch averaged 80.7 mm (N = 39; std. error = 1.3). The water surface in trapping areas averaged 14.2^{o}C and ranged from 12.2-16.4^{o}C.

Dudidontu River

Juvenile trapping and tagging was conducted at the Dudidontu River during 16 August-3 September. Access was by floatplane to a shallow lake 5.5 km in direct distance upstream from the confluence of the river with Kakuchuya Creek. The camp was located along a section of river that appeared to be the most suitable coho salmon rearing habitat in the system.

The Dudidontu River is a relatively clear tributary of the Nahlin River (Figure 3). It originates in numerous lakes and small streams on a high plateau area between two gentle, isolated mountain ranges and plunges approximately 550 meters through a steep sided canyon before joining the Nahlin River. Landslides are common in the canyon and salmon are vulnerable to being blocked from spawning and rearing areas. In 1978, a large landslide was observed in the canyon that formed a lake and appeared to completely block the chinook salmon escapement from the spawning area (Paul Kissner, ADF&G, personal communication). An early spawning coho salmon population in the system was assessed through aerial escapement surveys during 1986 and 1987.

Several sections of the Dudidontu River and its tributaries appeared to provide excellent rearing habitat for coho salmon. The river became slow and winding with overhanging banks, lush aquatic vegetation and some woody debris. There were beaver ponds, small tributary streams, side sloughs, and shallow lakes. There also appeared to be abundant, high quality spawning habitat throughout much of the system.

Trapping success, however, indicated that the population of rearing coho salmon was sparse. A total of 1,712 juvenile coho salmon (including 205 recaptured tagged fish) was captured in 1,237 trap sets for an average catch of 1.4 per trap. Fish that were captured averaged only 59.5 mm (N = 618; std. error = 0.4) and ranged from 44-132 mm (Appendix A.3). Only 1,217 met the minimum size for tagging of 55 mm. Almost all (98%) were young-of-the-year (age 0+; Appendix A.4).

The catch of chinook salmon was also relatively poor with a total catch of 4,065 (including 119 recaptured tagged fish), for an average catch of 3.3 per trap. A total of 3,575 chinook salmon was tagged. Chinook salmon that were

caught averaged 67.6 mm (N = 488; std. error = 0.3) and ranged from 50-89 mm (Appendix A.5). Scales taken from a selected sample of larger juveniles indicated that all were age 0+.

Chinook salmon were more abundant and thoroughly distributed throughout the mainstem compared with coho salmon. Coho salmon dominated trap catches in only a few sets that were made in partially submerged piles of willow that had been cut by beaver for winter feeding stations, and in one small slough behind a beaver dam. Locations that appeared to be excellent habitat (slow moving reaches with submerged vegetation, beaver ponds, side sloughs, undercut banks, small streams, and a shallow lake) produced very few coho salmon. Poor catches in the lake and in slow moving reaches of the mainstem may have been related to a high abundance of predators, particularly rainbow trout (*Salmo gairdneri*), while poor catches in some ponds and small streams may have been related to a very high abundance of Dolly Varden (*Salvelinus malma*), a potential competitor.

The Dudidontu River is similar in size and other features to the upper Nahlin River where juvenile salmon were trapped and tagged during 12-29 August 1986. Therefore, a comparison of numbers and species composition of fish caught in the two streams during approximately the same time of year may, to some extent, reflect actual similarities and differences in abundance and species composition in the two systems. The catch of both coho and chinook salmon in the Nahlin River was substantially greater, with average catch rates of 2.6 and 22.1, respectively, compared with 1.4 and 3.3 for the Dudidontu River (Table 2). The average length of coho salmon tagged at the Nahlin River was 81.7 mm. Only 43% were age 0+ compared with 98% age 0+ fish for the Dudidontu River. Age 1+ fish predominated in coho salmon catches from the Nahlin River. While no length-frequency data was collected from chinook salmon in the Nahlin River, only 5,403 fish of the total catch exceeded the minimum size for tagging (60 mm). Ninety-one percent of the chinook salmon caught in the Dudidontu River were 60 mm or larger. The mean length of juvenile chinook salmon in the Nahlin River in August 1986 was probably between 55-60 mm, compared with a mean length of 67.6 mm for the Dudidontu River in 1987.

There were significant differences in other species captured in the two streams. Sockeye salmon (*O. nerka*), burbot (*Lota lota*) and lake chubs (*Couesius plumbeus*) were present in the upper Nahlin River but were absent from catches in the Dudidontu River. Only one sculpin (*Cottus spp.*) was captured in the Dudidontu River while 523 were captured in the Nahlin River, for a total of 1.0% of the total catch. Rainbow trout and Dolly Varden were more abundant and comprised a larger percentage of the catch in the Dudidontu River. In particular, Dolly Varden were found in very small numbers in the Nahlin River (0.01 per trap; 0.1% of the total catch) but were the predominant species captured in the Dudidontu River (3.72 per trap; 43.1% of the total catch). Overall, juvenile salmon represented 98.6% of the total catch in the upper Nahlin River but only 54.2% of the total catch in the Dudidontu River.

Observed, but not quantified, were differences in the abundance of large fish (other than adult salmon) in the two streams. Resident rainbow trout and

Dolly Varden were relatively abundant in the Dudidontu River. Up to 30-40 rainbow trout ranging from 300-560 mm could be seen in each of a number of pools while somewhat smaller (up to 350 mm) Dolly Varden were distributed throughout the system. In the twilight hours the rainbow trout assumed feeding stations in fast water areas where the flow was constricted by partial beaver dams. Rainbow trout in the same size range were observed in the upper Nahlin River in 1986, but in much smaller numbers, while no large Dolly Varden were seen.

Periodic blockages and restrictions in spawner access through the Dudidontu River Canyon may result in an impaired ability by salmon species to compete for available habitat and food resources, and may indirectly result in increased predation. Resident salmonid species are relatively much more abundant in the Dudidontu River compared with the upper Nahlin River, suggesting that they may be utilizing habitat and food resources that would normally be more fully utilized by salmon. Perhaps, through natural selection, populations of Dolly Varden and rainbow trout have evolved more into resident forms rather than anadromous forms because of reduced spawning success of anadromous fish that must migrate upstream through the canyon to reach spawning areas. Therefore, more large salmonids may remain in the river year-round where they rely on local resources, including juvenile salmon, for food.

There are a number of potential explanations for the relative scarcity of age 1+ juvenile coho salmon in minnow trap catches in the Dudidontu River. Most of the population may outmigrate as age 1+ smolts. However, this explanation seems unlikely because the small average size of age 0+ fish in late summer indicates that dramatic growth would have to take place before spring for them to reach viable smolt size. The crew trapped all available habitat types which indicates that we probably did not overlook habitat that contained a relatively high density of large juveniles. The most likely explanation is that relatively few age 1+ coho salmon were present in the population because of low escapement and/or poor survival.

There is evidence that the chinook salmon population in the Dudidontu River is capable of substantially greater production than has been realized in recent years and that the stock is presently rebuilding. In 1958, a total of 4,500 chinook salmon spawners was counted in an aerial survey of the Dudidontu River (Kissner and Hubartt 1986) during a period when the population was subjected to relatively heavy exploitation. Helicopter surveys during 1975-1977 revealed an average of only 24 large spawners (range 15-40). Escapement counts during 1980-1983, the predominant return years for the 1975-1977 escapements, averaged 120 (range 74-158). Returns to date from the 1980-1983 escapements produced counts averaging 392 (range 287-476) during 1985-1987. In comparison, peak helicopter survey counts in the upper Nahlin River have averaged 1,352 large spawners (range 391-2,945) during the most recent 10 years (1978-1987) and have shown no consistent trend (Hubartt and Kissner 1987). The relatively large size of juvenile chinook salmon in the Dudidontu River indicated that density dependence among rearing chinook salmon may have been a less important factor limiting production there than in the upper Nahlin River.

Speel Lake

A total of 10,267 juvenile coho salmon was tagged at Speel Lake during 21 July-4 August (Table 1). The catch per trap averaged 10.3 coho salmon over 62 mm. All major habitat types were trapped including the perimeter of the lake, the outlet stream and beaver ponds on the inlet stream. The surface temperature averaged 18.8°C and ranged from 17.5-19.7°C.

ESCAPEMENT SURVEYS

Adult escapement surveys were conducted on two headwaters tributaries (upper Nahlin and Dudidontu Rivers) and on several mainstem tributaries.

Methods and Procedures

Helicopter surveys were conducted from an altitude of 6-15 m unless obstructions required flying higher. Airspeed varied from approximately 5-50 km per hour depending on terrain, visibility, and the presence or absence of fish. Surveys were conducted from a Bell 206 B Jet Ranger helicopter. The door on the observer's side was removed and the helicopter was maneuvered so that the observer was able to look down into the stream continuously from the left side. The observer wore polarized glasses to reduce reflective glare and a billed hat to keep prop wash out of the observer's eyes.

Results

Nahlin River Drainage

The upper Nahlin and Dudidontu Rivers were surveyed on 15 September (Table 3). The water level was low and visibility conditions were good on both rivers.

A total of 165 adult coho salmon was counted in the upper Nahlin River including 156 live fish and 9 carcasses. Also counted were 13 sockeye salmon.

A total of 276 adult coho salmon was counted in the Dudidontu River including 252 live fish and 24 carcasses. A total of four fish was counted in Kakuchuya Creek while all of the remainder were counted upstream from its junction with the main river. Most fish were distributed in the upper reaches near and within a beaver dam complex in the vicinity of Camp Island Lake.

Lower River Tributaries

Lower Taku River tributaries that were surveyed included Sockeye Creek, Fish Creek, Yehring Creek, Johnson Creek and Flannigan Slough. Warm weather and high rainfall during October precluded good quality surveys during the preferred time period of approximately 15-25 October. Conditions did not improve enough to conduct good surveys until 4 November. Two observers flying in the same helicopter made independent survey counts on that date for Sockeye Creek, Fish Creek, Yehring Creek, and Flannigan Slough (Table 4). A total of 130 fish was counted in Johnson Creek during a foot survey on 23 September. The ADF&G, Sport Fish Division operated a weir on Yehring Creek during 23 August-29 September. A total of 1,540 coho salmon was counted during that period. However, water passed over and around the weir during two periods providing an opportunity for a large proportion of the escapement to pass uncounted. An estimate of the total escapement to Yehring Creek may be made after completion of analysis of mark-recapture data.

Discussion

Escapement survey counts on the Nahlin and Dudidontu Rivers in 1987 were 52% and 35%, respectively, of 1986 counts. The weir count for the Hackett River, another early indicator stock, also decreased substantially between those two years from 2,723 in 1986 to 1,715 in 1987 (DFO data; Table 3).

In contrast, peak escapement counts for lower Taku River tributaries indicated that overall escapement of those stocks was problably larger than in 1986. However, the quality of counts on these streams is significantly affected by weather patterns in the fall. In 1986 and 1987, relatively warm, rainy weather during most of October delayed the first period of acceptable survey conditions until after a portion of the escapement was likely to have spawned and disappeared. Although it is turbid much of the year from glacial silt, high quality survey counts can be made in Flannigan Slough after 2-3 days of cold, clear weather. Abundance of spawners in the slough probably peaks during approximately 15-25 October. In 1984 and 1985, the slough became clear and counts were made on 21 October. However, in 1986 and 1987, surveys were delayed until 31 October and 4 November, respectively. In spite of the delayed survey in 1987, the peak survey count of 2,100 (average for two observers) was nearly twice the peak count of 1,095 in 1986 and compared favorably with counts of 2,320 in 1985 and 1,480 in 1984.

Although the Nahlin and Dudidontu Rivers are very suitable systems for conducting helicopter surveys from the standpoint of visibility, questions remain concerning comparability. Stream life and the duration of the migration into survey areas are unknown. The apparent juvenile population size in the upper Nahlin River in 1986 indicated that the adult escapement should have been substantially greater than what was observed (318 in 1986; 165 in 1987). If the average survival rate of tagged juveniles is comparable with Southeastern Alaska systems (average 5%) the 4,872 juvenile coho salmon tagged at the upper Nahlin River in 1986 are expected to represent about 244 adults of which perhaps between 50 and 120 are likely to escape to the

spawning area. However, the small proportion of available rearing habitat that was trapped in the Nahlin River and the low observed catch efficiency of minnow traps in other systems that have been studied indicates that the percent of the total population that was tagged must have been well under 10%. Therefore, based on available information, there appears to be some discrepancy between the aerial counts and the apparent rearing population.

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Table 1. Summary of coded-wire tagging of juvenile salmon in Taku River tributaries and at Speel Lake by the Alaska Department of Fish and Game, Commercial Fisheries Division, 1987.

Location	Species	Code	Number Tagged
Little Tatsamenie Lake	Coho	4-26-53	10,193
		4-26-47	1,233
		Total	11,426
Dudidontu River	Coho	4-26-45	1,217
	Chinook	4-26-60	3,575
Speel Lake	Coho	4-26-59	9,797
		4-26-46	470
		Total	10,267

Table 2. Total catch, species composition and average catch-per-trap for minnow traps set in the upper Nahlin River during 12 - 29 August 1986 and the Dudidontu River during 17 August - 2 September 1987.[1]

Species	Upper Nahlin River			Dudidontu River		
	Total Number[2]	% of Catch	Average No./Trap	Total Number[2]	% of Catch	Average No./Trap
Coho	5,286	10.32	2.62	1,712	16.06	1.38
Chinook	44,592	87.11	22.11	4,065	38.14	3.29
Sockeye	583	1.14	0.29	0	0.00	0.00
Rainbow Trout	159	0.31	0.08	283	2.65	0.23
Dolly Varden	24	0.05	0.01	4,598	43.14	3.72
Burbot	19	0.04	0.01	0	0.00	0.00
Sculpins	523	1.02	0.26	1	0.01	0.00
Lake Chub	3	0.01	0.00	0	0.00	0.00

1 Total number of trap sets: Nahlin River 2,017; Dudidontu River 1,237. Average water temperature: Nahlin River 8.3°C (range 6.7-9.7°C); Dudidontu River 10.4°C (range 8.9-11.1°C).

2 Total number captured includes recaptures.

Table 3. Peak escapement counts for the three upper Taku River early migrating and spawning coho salmon stocks.

Location	Year	Type	Date(s)	Agency	No. of Fish
Upper Nahlin River	1986	Helicopter	09/18-19	ADF&G	318
	1987	Helicopter	09/15	ADF&G	165
Dudidontu River	1986	Helicopter	09/18	ADF&G	798
	1987	Helicopter	09/15	ADF&G	276
Hackett River[1]	1985	Weir	08/06-10/20	DFO	1,032
	1986	Weir	08/03-10/10	DFO	2,723
	1987	Weir	08/08-10/13	DFO	1,715

1 Canada Department of Fisheries and Oceans data.

Table 4. Summary of coho salmon escapement surveys conducted on five lower Taku River tributaries, 1987.

Location	Stream No.	Date	Type	Fish	Visibility	Observer
Sockeye Creek	111-32-038	11/04	Helicopter	1,040	Excellent	Muir
		11/04	Helicopter	840	Excellent	Elliott
Fish Creek	111-32-056	11/02	Helicopter	250	Excellent	Elliott
Yehring Creek	111-32-066	10/09	Helicopter	340	Poor	Shaul
		10/09	Helicopter	220	Normal	Elliott
		11/02	Helicopter	355	Excellent	Elliott
		11/04	Helicopter	590	Excellent	Muir
		11/04	Helicopter	520	Excellent	Elliott
Johnson Creek	111-32-068	09/03	Foot	130	Excellent	Kuntz
Flannigan Slough	111-32-203	11/02	Helicopter	350	Poor	Elliott
		11/04	Helicopter	1,950	Excellent	Muir
		11/04	Helicopter	2,250	Excellent	Elliott

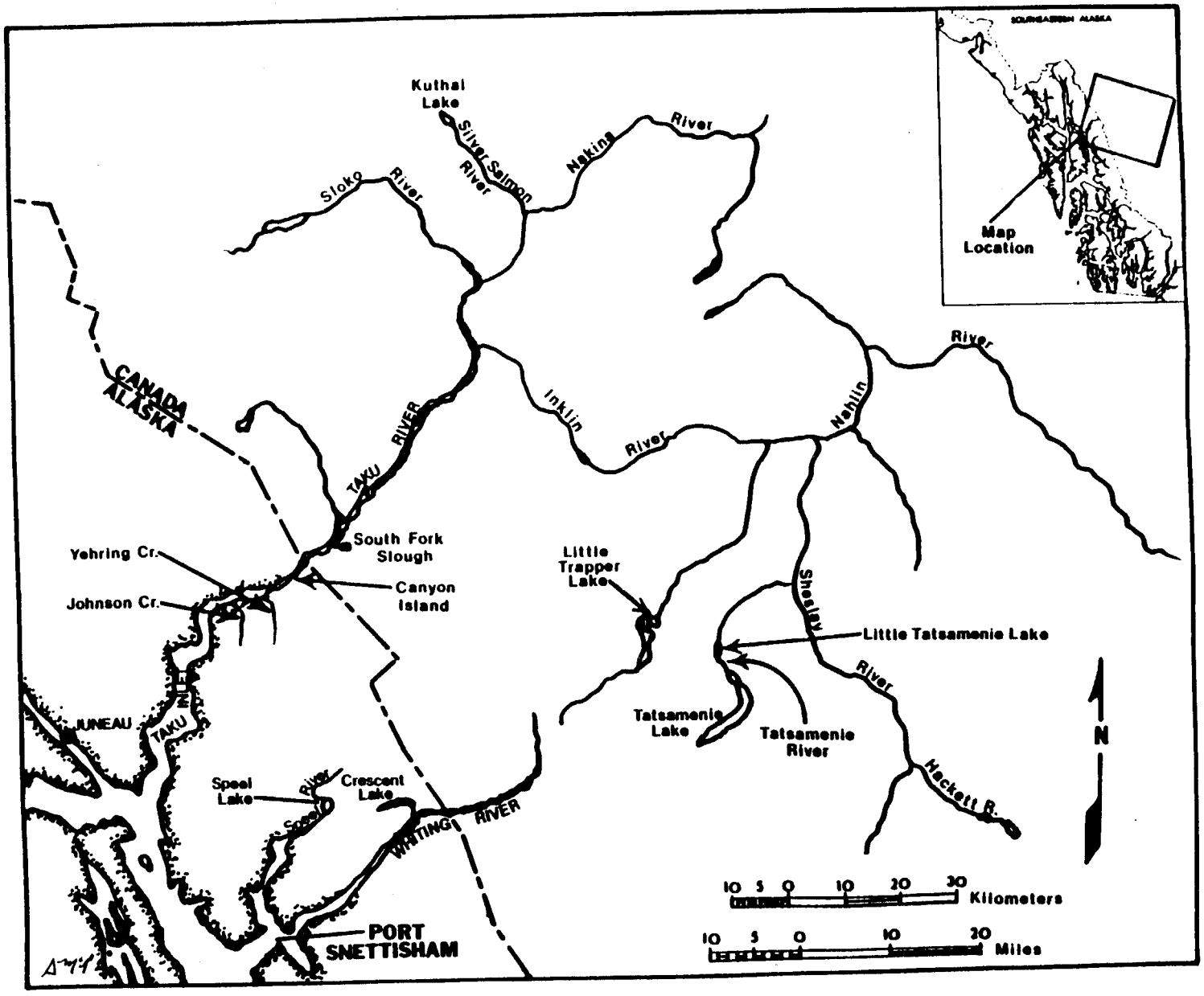

Figure 1. Taku River and Port Snettisham drainages.

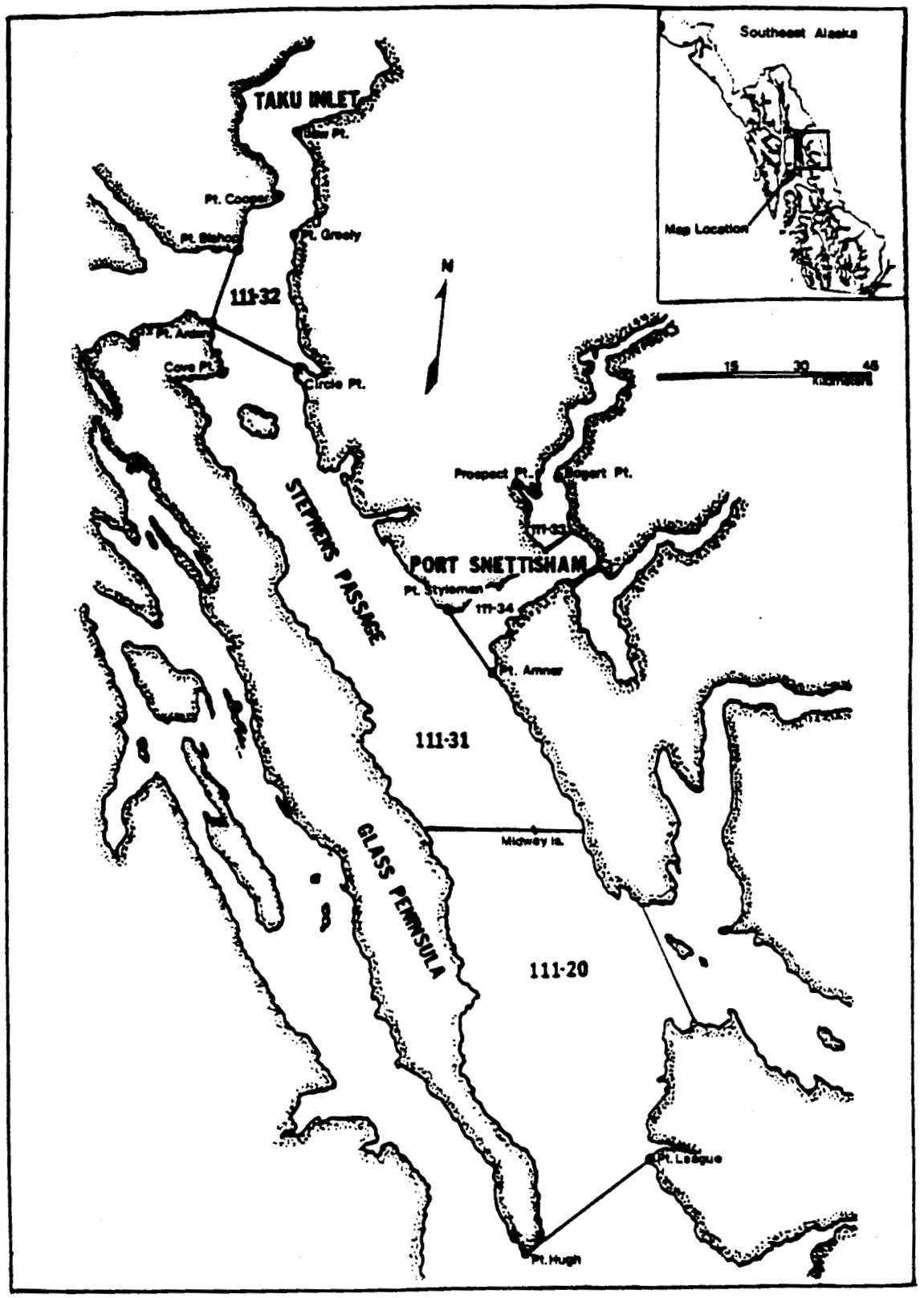

Figure 2. District 111 fishing areas.

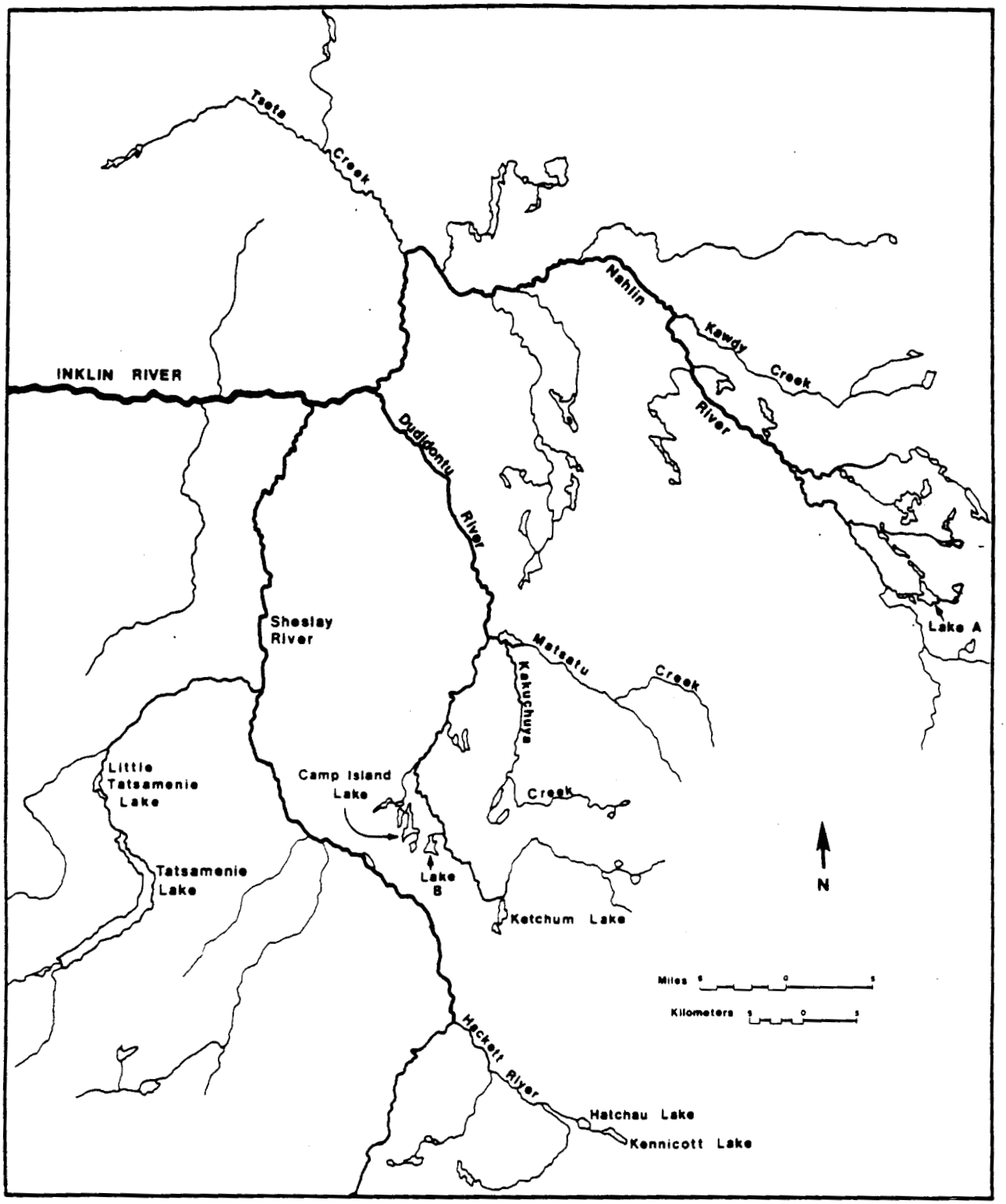

Figure 3. Upper Inklin River drainage.

APPENDICES

Appendix A.1. Length-frequency distribution of juvenile coho salmon tagged at Little Tatsamenie Lake, 21 July-13 August 1987.

Length (mm)	Number of Fish	Length (mm)	Number of Fish	Length (mm)	Number of Fish
60	52	89	12	118	0
61	14	90	22	119	0
62	25	91	10	120	0
63	19	92	13	121	1
64	19	93	6	122	0
65	42	94	3	123	0
66	21	95	12	124	0
67	12	96	5	125	0
68	22	97	2	126	0
69	14	98	4	127	0
70	14	99	7	128	0
71	12	100	9	129	0
72	18	101	4	130	0
73	11	102	1	131	0
74	17	103	5	132	0
75	44	104	1	133	0
76	15	105	5		
77	13	106	1		
78	31	107	2	Total	712
79	14	108	3		
80	39	109	0	Mean	76.78
81	10	110	2		
82	23	111	0	Variance	146.12
83	6	112	0		
84	12	113	0	Standard Deviation	12.09
85	28	114	1		
86	14	115	0		
87	11	116	0	Standard Error	0.45
88	9	117	0		

Appendix A.2. Age-length sample from juvenile coho salmon tagged at Little Tatsamenie Lake, 21 July-13 August 1987.

Length (mm)	Number of Fish			Length (mm)	Number of Fish		
	Age 0+	Age 1+	Total		Age 0+	Age 1+	Total
60	10	0	10	103	0	0	0
61	4	0	4	104	0	0	0
62	3	0	3	105	0	1	1
63	5	0	5	106	0	0	0
64	5	0	5	107	0	0	0
65	2	0	2	108	0	0	0
66	3	0	3	109	0	0	0
67	2	1	3	110	0	0	0
68	2	0	2	111	0	0	0
69	1	0	1	112	0	0	0
70	0	0	0	113	0	0	0
71	0	2	2	114	0	0	0
72	1	2	3	115	0	0	0
73	1	0	1	116	0	0	0
74	1	0	1	117	0	0	0
75	0	5	5	118	0	0	0
76	1	4	5	119	0	0	0
77	0	1	1	120	0	0	0
78	0	2	2	121	0	0	0
79	0	2	2	122	0	0	0
80	0	3	3	123	0	0	0
81	0	3	3	124	0	0	0
82	0	1	1	125	0	0	0
83	0	2	2	126	0	0	0
84	0	1	1	127	0	0	0
85	0	3	3	128	0	0	0
86	0	0	0	129	0	0	0
87	0	2	2	130	0	0	0
88	0	0	0	131	0	0	0
89	0	1	1	132	0	0	0
90	0	1	1	133	0	0	0
91	0	0	0				
92	0	0	0	Total	41	39	80
93	0	0	0				
94	0	0	0	Mean	64.07	80.72	72.19
95	0	0	0				
96	0	0	0	Variance	17.27	61.89	108.61
97	0	0	0				
98	0	1	1	Standard			
99	0	1	1	Deviation	4.16	7.87	10.42
100	0	0	0				
101	0	0	0	Standard			
102	0	0	0	Error	0.65	1.26	1.17

Appendix A.3. Length-frequency distribution of juvenile coho salmon from the Dudidontu River, 22 August 1987.

Length (mm)	Number of Fish	Length (mm)	Number of Fish	Length (mm)	Number of Fish
44	3	78	2	113	0
45	3	79	1	114	0
46	1	80	0	115	0
47	2	81	6	116	0
48	5	82	2	117	0
49	10	83	0	118	0
50	21	84	4	119	1
51	24	85	0	120	0
52	28	86	1	121	0
53	40	87	0	122	0
54	50	88	0	123	0
55	62	89	2	124	0
56	45	90	0	125	0
57	33	91	1	126	0
58	32	92	2	127	0
59	48	93	0	128	0
60	32	94	0	129	0
61	22	95	0	130	0
62	26	96	1	131	1
63	21	97	0	132	1
64	9	98	2		
65	12	99	1		
66	9	100	2		
67	7	101	0	Total	618
68	7	102	1		
69	3	103	0	Mean	59.48
70	4	104	2		
71	4	105	0	Variance	107.54
72	5	106	0		
73	5	107	0	Standard	
74	1	108	0	Deviation	10.37
75	4	109	1		
76	2	110	0	Standard	
77	4	112	0	Error	0.42

Appendix A.4. Age-length of juvenile coho salmon from the Dudidontu River, 22 August 1987.

Length (mm)	Number of Fish			Length (mm)	Number of Fish		
	Age 0+	Age 1+	Total		Age 0+	Age 1+	Total
44	1	0	1	95	0	0	0
45	1	0	1	96	0	0	0
46	1	0	1	97	0	0	0
47	1	0	1	98	2	0	2
48	0	0	0	99	0	0	0
49	2	0	2	100	1	0	1
50	5	0	5	101	0	0	0
51	10	0	10	102	0	0	0
52	7	0	7	103	0	0	0
53	9	0	9	104	1	0	1
54	12	0	12	105	0	0	0
55	18	1	19	106	0	0	0
56	12	0	12	107	0	0	0
57	10	0	10	108	0	0	0
58	10	0	10	109	0	0	0
59	6	0	6	110	0	0	0
60	7	0	7	111	0	0	0
61	7	0	7	112	0	0	0
62	4	0	4	113	0	0	0
63	2	0	2	114	0	0	0
64	1	0	1	115	0	0	0
65	3	0	3	116	0	0	0
66	2	0	2	117	0	0	0
67	1	0	1	118	0	0	0
68	2	0	2	119	0	0	0
69	0	0	0	120	0	0	0
70	1	0	1	121	0	0	0
71	0	0	0	122	0	0	0
72	3	0	3	123	0	0	0
73	1	0	1	124	0	0	0
74	0	0	0	125	0	0	0
75	0	0	0	126	0	0	0
76	1	0	1	127	0	0	0
77	2	0	2	128	0	0	0
78	0	0	0	129	0	0	0
79	1	0	1	130	0	0	0
80	0	0	0	131	0	0	0
81	0	0	0	132	0	1	1
82	1	0	1				
83	0	0	0				
84	0	0	0	Total	149	3	152
85	0	0	0				
86	0	0	0	Mean	58.72	93.00	59.40
87	0	0	0				
88	0	0	0	Variance	96.47	761.00	111.77
89	1	0	1				
90	0	0	0	Standard			
91	0	0	0	Deviation	9.82	27.59	10.57
92	0	1	1				
93	0	0	0	Standard			
94	0	0	0	Error	0.80	15.93	0.86

Appendix A.5. Length-frequency distribution of juvenile chinook salmon from the Dudidontu River, 22 August 1987.

Length (mm)	Number of Fish	Length (mm)	Number of Fish	Length (mm)	Number of Fish
44	0	78	7	113	0
45	0	79	5	114	0
46	0	80	3	115	0
47	0	81	1	116	0
48	0	82	3	117	0
49	0	83	2	118	0
50	1	84	1	119	0
51	0	85	2	120	0
52	0	86	1	121	0
53	0	87	0	122	0
54	0	88	2	123	0
55	3	89	1	124	0
56	7	90	0	125	0
57	5	91	0	126	0
58	13	92	0	127	0
59	14	93	0	128	0
60	15	94	0	129	0
61	16	95	0	130	0
62	27	96	0	131	0
63	25	97	0	132	0
64	33	98	0		
65	33	99	0		
66	31	100	0		
67	31	101	0	Total	488
68	36	102	0		
69	26	103	0	Mean	67.58
70	28	104	0		
71	18	105	0	Variance	37.81
72	26	106	0		
73	19	107	0	Standard	
74	14	108	0	Deviation	6.15
75	20	109	0		
76	15	110	0	Standard	
77	4	112	0	Error	0.28